PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :
B32B 27/06, 5/18, B42D 15/00, 15/10

A1

(11) International Publication Number: **WO 99/67093**

(43) International Publication Date: 29 December 1999 (29.12.99)

(21) International Application Number: PCT/GB99/01987

(22) International Filing Date: 24 June 1999 (24.06.99)

(30) Priority Data:
9813783.9 25 June 1998 (25.06.98) GB

(71) Applicant *(for all designated States except US)*: DE LA RUE INTERNATIONAL LIMITED [GB/GB]; De La Rue House, Jays Close, Viables, Basingstoke, Hampshire RG22 4BS (GB).

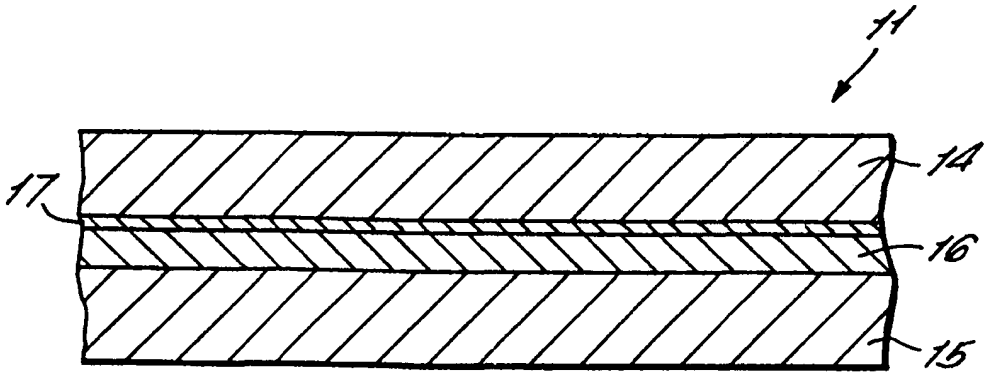
(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: AMES, Christopher, John [GB/GB]; 20 Hartsbourne Road, Earley, Reading, Berkshire RG6 5PY (GB).

(74) Agent: BOULT WADE TENNANT; 27 Furnival Street, London EC4A 1PQ (GB).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: IMPROVEMENTS IN SECURITY DOCUMENTS AND SUBSTRATES THEREFOR



(57) Abstract

The invention relates to improved security documents such as banknotes, cheques and passports which are required to provide a high degree of security against imitation and a substrate for producing such security documents. The invention therefore provides a substrate for security documents comprising at least a plurality of layers of polymeric film (14, 15) laminated together with at least one metallic layer (17) therebetween, wherein at least one of the polymeric layers is biaxially oriented and at least another comprises an opaque voided film wherein the opacity of at least a portion of the voided polymeric layer is reduced.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

IMPROVEMENTS IN SECURITY DOCUMENTS AND SUBSTRATES THEREFOR

The invention relates to improved security documents such as banknotes, cheques and passports which are required to provide a high degree of security against imitation and a substrate for producing such security documents.

Such documents are traditionally made from security paper, that is paper having good durability and a high resistance to crumpling and tearing. However, such documents are still prone to damage through water, cutting and eventual wear. Furthermore such security documents are vulnerable to forgery.

To prevent counterfeiting it is widely known to use in traditional banknotes and security documents, security devices such as security threads or strips which are made from a transparent polyester film provided with a wholly or partially reflective metallised layer. The threads are wholly or partially embedded within the paper and provide a high degree of security against counterfeiting. However, the paper itself is still subject to a degree of wear and damage.

This problem has been addressed in International Patent Application WO83/00659 which describes a plastic banknote. This banknote is made up from one or more films of transparent biaxially oriented polymers which are coated with layers of relatively opaque printing ink and heat activated adhesive material. An optically variable security device such as a diffraction grating is adhered to the substrate in a window left in the opaque layer. The substrate is then printed with identifying indicia and covered on both sides by further layers of polymer material. Most counterfeiters do not have access to equipment for making such materials and plastic banknotes are

damage and wear resistant. It should be noted that whilst biaxially oriented polymer films such as those described in WO83/00659 have excellent resistance to tear initiation (i.e. edge tear resistance) they have poor resistance to tear propagation (i.e. internal tear resistance) when compared to paper.

US 5618630 and WO97/01438 describe multi-layer film structures for use in the production of banknotes. In WO97/01438 the substrate utilises at least two films with unbalanced biaxial orientation laminated such that the major axis of orientation are eventually parallel. US 5618630 differs in that the major orientation axis are essentially perpendicular. The basic substrate of these prior art documents is substantially clear and requires an opacifying coating or ink to be applied for information can be printed thereon for use as a banknote.

It is an object of the present invention to provide improved security documents and substrates therefor made from a polymeric material to address the problems of durability, especially low tear propagation resistance, and counterfeitability.

According to the invention there is provided a substrate for security documents comprising at least a plurality of layers of polymeric film laminated together with at least one metallic layer therebetween, wherein at least one of the polymeric layers is biaxially oriented and at least another comprises an opaque voided film wherein the opacity of at least a portion of the voided polymeric layer is reduced.

At least a portion of the voided polymeric layer is preferably transparentised.

At least a portion of the substrate is preferably subjected to pressure and heat treatment to provide an area of varying thickness which is detectable by touch.

Preferably the at least one metallic layer is partially demetallised

Preferably the at least one metallic layer has a translucent coloured coating on one or both sides.

A plurality of metallic layers is preferably located between the polymeric layers.

The metallic layers are preferably provided by different metals.

At least one metallic layer may provide an electrically conductive path along the width or length of the substrate.

A magnetic material may be located between the polymeric layers.

The magnetic material may be located between at least two metallic layers.

All external polymeric layers may comprise opaque voided films.

Preferably one of the external polymeric layers is transparent.

At least one internally printed layer is preferably provided between the polymeric layers.

The ink may be coloured and translucent or opaque.

The ink may be luminescent.

The thicknesses of at least two of the polymeric layers are preferably different.

The invention also provides a security document produced from the substrate, on the external surfaces of which are printed indicia.

Indicia may be printed on the internal surfaces of one or more of the polymeric layers.

Identifying indicia may be printed on the external surfaces of the substrate and the internal surfaces of one or more of the polymeric layers.

The invention will now be illustrated by the following examples with reference to the accompanying

drawings, in which:-

Figs. 1 and 3 to 6 are longitudinal cross-sectional side elevations of alternative embodiments of a substrate for a security document according to the present invention; and

Fig. 2 is a plan view of a security document according to the present invention.

Example 1

As shown in Fig. 1, the substrate 11 comprises a laminate of at least two polymeric layers 14, 15 laminated together with at least one partial or whole layers of metal 17 sandwiched between the polymeric layers 14, 15.

Layer 14 is preferably a biaxially oriented transparent polymeric film which has been metallised with a layer 17 of metal. The metal layer 17 may be vacuum deposited aluminium, although another metal such as gold may be used. The metallised film 14, 17 may be an
SHM (™) film from Hoechst Trespaphan which is available in various thicknesses.

Layer 15 comprises a relatively opaque voided polymer film, sometimes referred to as opalescent or pearlised, instead of a transparent polymer film. Such pearlised films are rendered partially opaque by minute voids within the film. These may be caused by a variety of processes; in some the orientation process alone initiates the voids, in others an immiscible polymer is added or a finely divided pigment. These voids, however caused, scatter incident or transmitted light to cause a degree of opacity. The degree of opacity is intermediate between transparent films and heavily pigmented, fully opaque films, and the degree of opacity depends on how

the film is voided, the number and size of the voids formed and the pigment, if any. Examples of such voided films suitable for use in the present invention include Valeron (™) from Van Leer Flexible Packaging, SHP (™) from Hoechst Trespaphan and Oppalyte (™) from Mobil. Typical thicknesses range from 35 to 125 microns according to the material used.

A major advantage of the preferred Valeron film lies in its unique structure. The film is a cross-laminate made from two essentially monoaxially oriented thermoplastic polymeric films, which have been slit at an angle to the orientation axis as described in GB 1577128. When a multiplicity (usually two) of these monoaxial films are suitably laminated the resulting cross-ply laminate has superior tear propagation resistance to a typically biaxially oriented film. This is particularly suitable for security documents, which may be pinned or stapled, and are therefore prone to tear initiation. These cross-ply laminates are available as an essentially transparent film (e.g. Valeron HS (™), a relatively opaque film without pigment and a pigmented opaque film (various Valeron grades) from Van Leer Flexible Packaging.

An advantage of using these relatively opaque films lies in the ability to collapse the voids, for example by the application of pressure or heat and pressure, thereby reducing the light scattering property of the collapsed voids. This may be done selectively, for example by using a hot stamping die, or an intaglio or alto plate to provide the substrate with indicia, ranging from pseudo watermarks to wholly transparent windows, depending on the characteristics of the voided film.

Thus, when such a voided film is used as the layer 15, the heat and pressure treatment can be used to reveal the metallic layer 17 in selected regions

without the need for a transparent polymeric layer.

The metal layer 17 within the substrate 11 further increases the opacity of such voided films so that a substrate 11 having a combination of opaque and metallic regions on one side and just metallic regions on the opposite side can be formed.

The substrate may also include additional security features, such as printed indicia, security devices and so on sandwiched between the polymeric layers. The outermost polymeric layers protect these features from damage or removal and may be used to conceal them.

As an alternative to lamination using an adhesive, the polymeric films selected may be co-extruded multilayer thermoplastic films, of the type used in heat sealable packaging films, which may be laminated together when thermally activated.

The layers 14, 15 are preferably laminated together with a layer of a suitable adhesive, such as a cross-linking or thermally activated adhesive 16, with the metallic layer 19 located between the transparent layers 14, 15 so that it is wholly encapsulated within the substrate 11. As the layer 14 is transparent, the shiny metallic layer 19 can be seen from that side of the substrate 11. The opaque layer 15 provides a suitable background to be printed with superficial indicia 12, such as identifying indicia, to form a security document 10, such as illustrated in Fig. 2, the superficial indicia 12 can be seen clearly. Other indicia may be printed in a translucent medium on the layer 14 to provide a coloured metallic appearance, similar to coloured metallic foils (hot stamped or otherwise applied) and of enhanced reflective appearance to surface applied metallic inks.

Example 2

In another embodiment of the invention both of the external layers of film 14, 15 are voided films with regions of collapsed voids providing windows 25. In reflected light the non-windowed areas are white and opaque. In any windowed regions 25 the shiny metal layer 17 can be seen in reflected light.

Example 3

In a modification of the substrate 11 described in example 1 or example 2, the metal layer 14 may be selectively metallised or demetallised, as shown in Fig. 3, to leave regions of opaque metal 18 and clear regions 19, which regions 18, 19 form embedded indicia 13. The embedded indicia 13 may be of a positive nature, i.e. the indicia 13 formed by the metallic regions 18, or negative in which the indicia 13 are formed by the clear regions 19. The indicia 13 may be in the form of alphanumeric text, a pattern, or any other appropriate form, some examples of which are shown in Fig. 2.

The substrate 11 incorporating embedded indicia 13 may then be subsequently printed with superficial indicia 12 or, if the embedded indicia 13 constitute identifying indicia, the pre-imaged substrate 11 may be used as a security document in its own right.

Fig. 2 illustrates a security document 10 produced from a substrate as described above in which the layer 15 is provided by a voided film. When viewed from the side of the substrate 11 formed by a voided film layer, the document 10 is mainly opaque white, the shiny metal regions 18 forming indicia 13 which are partially revealed in one or more windows 25 which have been created in the layer 15 by hot stamping or one form of void collapsing process. The demetallised regions 19, where viewed through the windows 25, are transparent. When viewed from the

side formed by a transparent layer 14, the indicia can be seen as bright shiny metallic regions 18 against a white background, except where windows 25 are provided. The resulting effect can be further enhanced by coating the metal regions 18 with a coloured translucent ink as in example 6, which contrasts with the white of the voided film layer 15.

When imaging substrates 11 made from such voided films by hot stamping, cold stamping or intaglio printing and embossing, the surface of the resulting substrate 11 varies to provide a useful tactile effect.

The ability to image the substrates 11 in the manner described above by collapsing the voids means that it can be carried out after external indicia 12 have been applied to the security document.

The pattern forming the embedded indicia 13 may be a screen pattern which gives variable opacity, for example a continuous change in opacity by making the screen ruling or dot size progressively smaller or larger.

The selective demetallisation may also be used to provide embedded indicia in the form of a moiré pattern so that when the substrate 11 is placed between the viewer windows of a detector, an image is revealed by interference with a design in the detector window.

The demetallisation of large areas of the metallised layer 14 may also be used to provide a pseudo watermark effect with very high resolution, similar to that achieved by intaglio printing.

Such selective demetallisation provides a high quality image with good resolution.

For the demetallisation process, any suitable methods may be used, such as direct etching or indirect etching using a resist. Where the indirect resist and etch method is used, coloured resist

materials may be employed which leaves a layer or translucent coloured matieral on the metallised regions 18 resulting in indicia 13 having a good coloured metal effect.

Alternatively a selective metallisation process may be used or the metal regions 18 may be created by printing with a high reflectivity metallic ink.

Another alternative to making the substrate 11 illustrated in Fig. 3 would be to laminate one polymeric layer 14 with a pre-imaged metal foil layer. A further alternative would be to image the metallic layer by laser cutting or ablation of the metal either as an intermediate step in the construction of the substrate, or subsequent to its assembly. This would be particularly useful for metal other than aluminium, e.g. stainless steel.

Example 4

In another modification of the substrate 11 (not illustrated), both layers 14, 15 are wholly metallised. In this example, layers 14, 15 are metallised with different metals having different appearances or colours, e.g. aluminium and gold. Thus the substrate 11 will have different appearances when viewed from each side in reflected light through a window or windows in the voided film layer 15 or through the transparent layer 14, e.g. silver from one side and gold from the other.

Example 5

The substrate 11 of example 3 may be further modified as shown in Fig. 4 by providing one fully metallised layer 15, 20 and one selectively demetallised layer 14,18 wherein the metal layer 20 is a metal having a different visual appearance from the metal regions 18. Alternative methods may be used of achieving a different metallic appearance by the use

of translucent coloured layers or coatings, e.g. by dyeing the adhesive layer. Thus if the full metal layer 20 is gold and the metal regions 18 are aluminium, the appearance of the substrate 11 when viewed in reflected light from the direction of arrow B will be gold. When viewed from the direction of arrow A the substrate 11 will appear to be silver in the metallised regions 18 and gold in the demetallised regions 19. Obviously the reference to viewing is through the transparent layer 14 or window(s) in the voided layer 15.

Example 6

In a further modification of example 4, as shown in Fig. 5, both layers 14, 15 may be selectively demetallised having metallised regions 18a, 18b and demetallised regions 19a, 19b respectively. Thus if regions 18a are gold and 18b are aluminium, when the substrate 11 is viewed in reflected light from the direction of arrow B, the embedded indicia 13 will appear silver where regions 18b are present, having some gold regions where regions 18b are absent but where regions 18a are present. There may be some transparent non-metallised regions, where no metal is present on either layer 14, 15, say at arrow C. When viewed from the direction of arrow A, the embedded indicia 13 will appear gold having some silver regions with some transparent non-metallised regions also present.

Alternatively, a number of different partially metallised polymeric layers could be laminated together all bearing different metallic patterns of the same metal so as to create a 3-dimensional watermark effect.

In all of the aforementioned examples, where there is a continuous metal path either along the

length or width of the substrate, this provides an electrically conductive path which can be used for authentication using appropriate machine readers.

Example 7

Any of the aforementioned examples may be modified by overprinting with a translucent coloured ink to give a coloured metallic effect. The translucent coloured ink may be applied directly to one or more of the metal layer or layers 18, 18a, 18b, 20 before the polymeric layers 14, 15 are laminated together.

Example 8

The security of documents produced from substrates according to the present invention may be further enhanced by the provision of additional embedded indicia 13 formed by printing 26 on the inner surface(s) of the layer 14 before laminating to be visible over or through the metal layer (s). The printing 26 may be provided by black or other coloured translucent or opaque inks or inks containing luminescent materials which are invisible until activated by appropriate heat or light sources, such luminescence to include fluorescence, phosphorescence and excitation by UV, IR, visible light and other radiation as appropriate. In the example shown in Fig. 6, polymeric layer 14 is partially demetallised, having metal regions 18, whilst layer 15 is wholly metallised having a layer of metal 20. A fluorescent ink layer 26 is printed over the metal layer 20 before lamination. Thus when the substrate 11 is viewed from the direction of arrow B through window(s) in the voided film, layer 15, the shiny metallic colour of the metal layer 20 will be seen. When substrate 11 is viewed from the direction of arrow A, when viewed under an ultraviolet light source the substrate 11

will fluoresce in the demetallised regions 19.

Example 9

Such internally printed embedded indicia 13 as described in example 8 could combine metameric inks, for simple or sophisticated detector authentication features. For example a tinted or coloured lacquer may be used to hide a Delacode or Delachrome image. Infra red readable and non-readable inks could be used for features visible by transmission.

Example 10

Such internally printed embedded indicia 13 may also include a magnetic pigmented ink or inks which provide a magnetically readable security feature for authentication at one or more levels of security according to the complexity of the designs and materials used. Where such magnetic features are used between two layers of opaque voided or metallised film, the magnetic feature provides a hidden machine-readable feature.

Example 11

Further additional security features may be embedded between the outermost polymeric layers 14, 15 of the substrate, such as diffraction gratings, holograms, RF antennae, printed circuits and so on. It is particularly advantageous to be able to embed such features, as opposed to having them mounted on the surface of the substrate, as they are not then prone to chemical attack, such as hydrolysis, or to mechanical abrasion and are protected against removal or damage.

It should be understood that although many of the examples above have been described with reference to two polymeric layers 14,15 only, the substrate 11 may

comprise a laminate of more than two such layers each having the same or different features described in the examples.

The substrate described in the aforegoing examples can be used to make a whole range of security documents including banknotes, cheques and passports.

CLAIMS:

1. A substrate (11) for security documents comprising at least a plurality of layers (14, 15) of polymeric film laminated together with at least one metallic layer (17) therebetween, wherein at least one of the polymeric layers (14) is biaxially oriented and at least another (15) comprises an opaque voided film wherein the opacity of at least a portion of the voided polymeric layer is reduced.

2. A substrate (11) as claimed in claim 1 in which at least a portion of the voided polymeric layer (15) is transparentised.

3. A substrate (11) as claimed in any one of the preceding claims in which at least a portion of the substrate (11) has been subjected to pressure and heat treatment to provide an area of varying thickness which is detectable by touch.

4. A substrate (11) as claimed in any one of the preceding claims in which the at least one metallic layer (17) is partially demetallised.

5. A substrate (11) as claimed in any one of the preceding claims in which the at least one metallic layer (17) has a translucent coloured coating on one or both sides.

6. A substrate (11) as claimed in any one of the preceding claims further comprising a plurality of metallic layers (17, 18, 20) located between the polymeric layers.

7. A substrate (11) as claimed in claim 6 in which the metallic layers (17, 18, 20) are provided by

different metals.

8. A substrate (11) as claimed in any one of the preceding claims in which at least one metallic layer (17) provides an electrically conductive path along the width or length of the substrate.

9. A substrate (11) as claimed in any one of the preceding claims further comprising a magnetic material between the polymeric layers (14, 15).

10. A substrate (11) as claimed in claim 9 as dependent on any one of claims 6 to 8 in which the magnetic material is located between at least two metallic layers.

11. A substrate (11) as claimed in any one of the preceding claims in which all external polymeric layers (15) comprise opaque voided films.

12. A substrate (11) as claimed in any one of claims 1 to 10 in which one of the external polymeric layers (14) is transparent.

13. A substrate (11) as claimed in any one of the preceding claims further comprising at least one internally printed layer between the polymeric layers (14, 15).

14. A substrate (11) as claimed in claim 13 in which the ink used for the printed layer is coloured and translucent or opaque.

15. A substrate (11) as claimed in claim 13 in which the ink used for the printed layer is luminescent.

16. A substrate (11) as claimed in any one of the

preceding claims in which the thickness of at least two of the polymeric layers (14, 15) are different.

17. A security document comprising a substrate (11) as claimed in any one of the preceding claims on the external surfaces of which are printed indicia.

18. A security document comprising a substrate (11) as claimed in any one of claims 1 to 16 in which indicia are printed on the internal surfaces of one or more of the polymeric layers (14, 15).

19. A security document as claimed in claim 17 or 18 in which identifying indicia are printed on the external surfaces of the substrate (11) and the internal surfaces of one or more of the polymeric layers (14, 15).

FIG. 1.

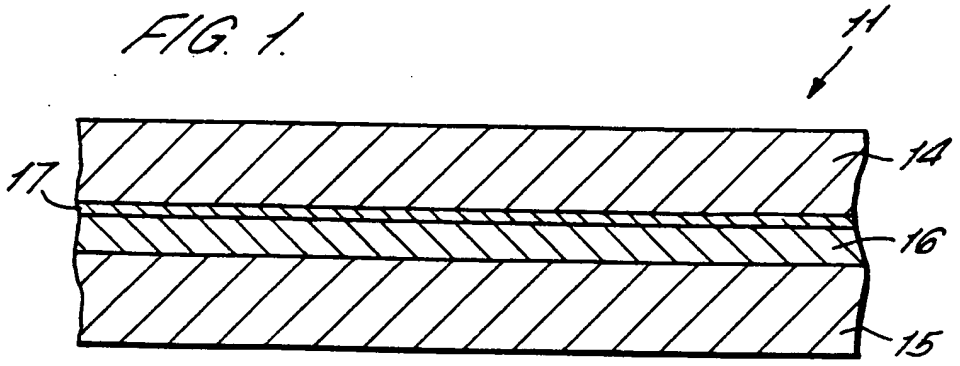


FIG. 2.

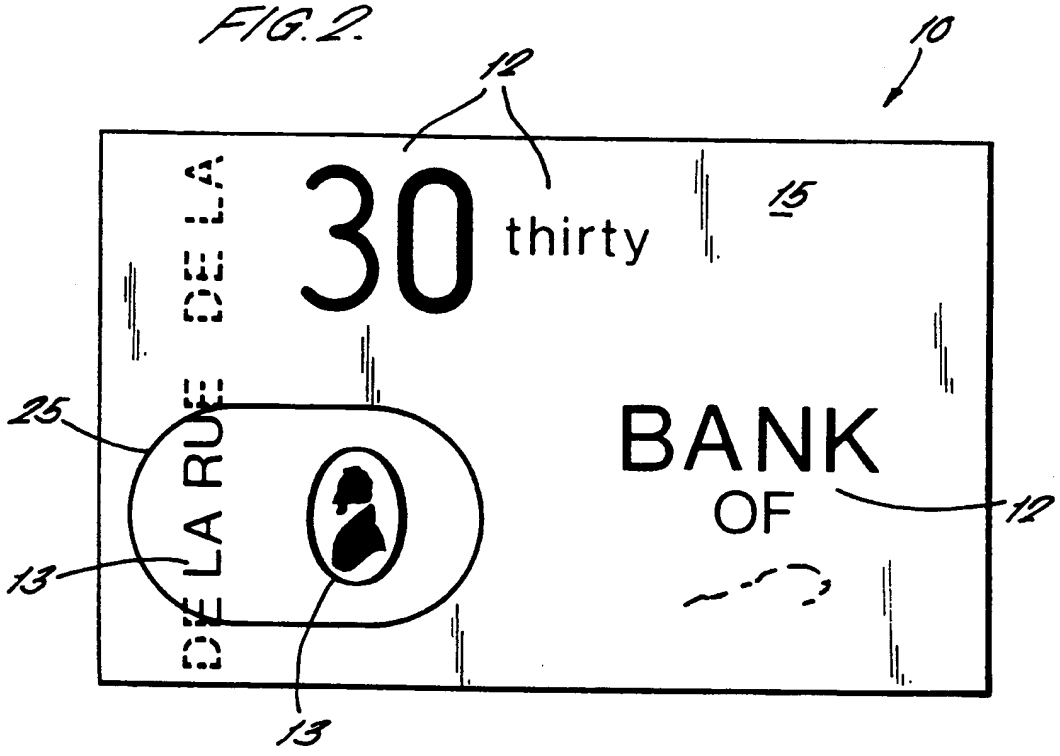


FIG. 3.

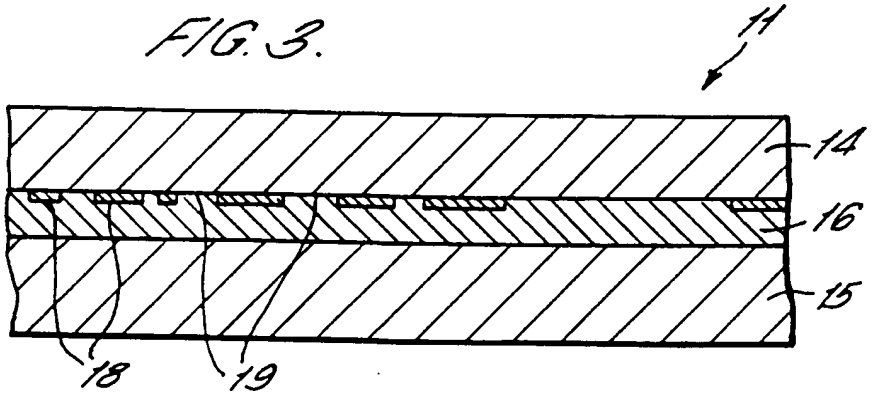


FIG. 4.

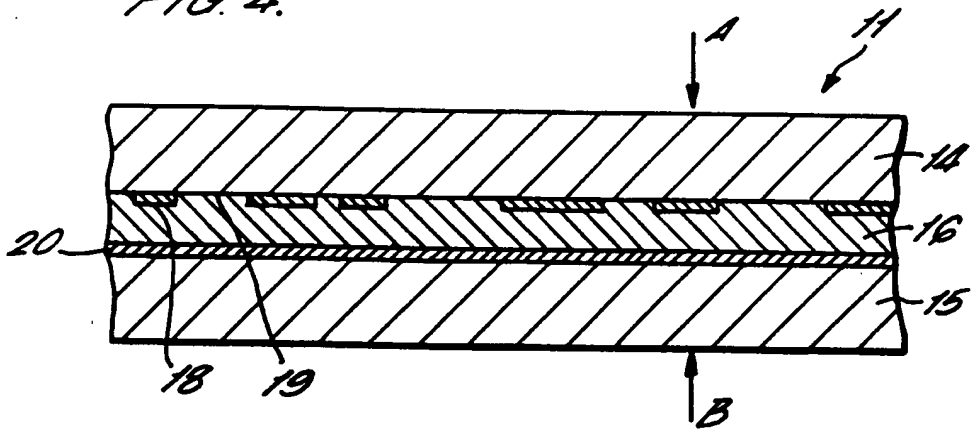


FIG. 5.

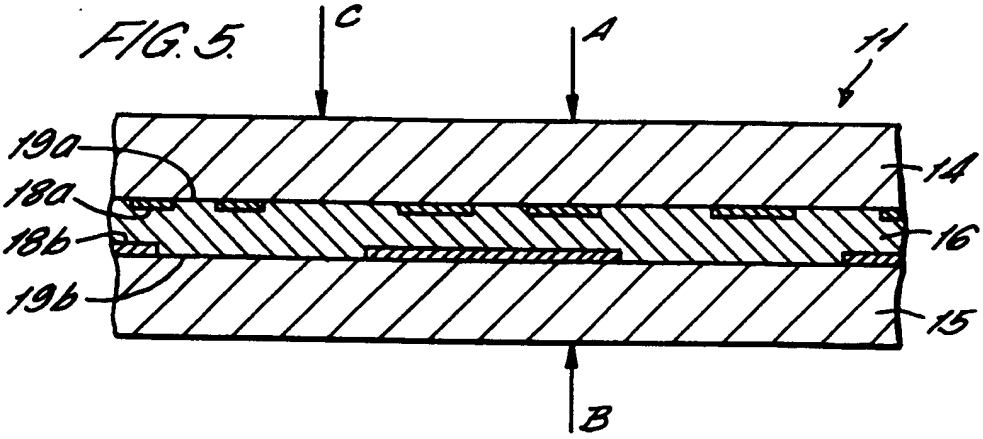
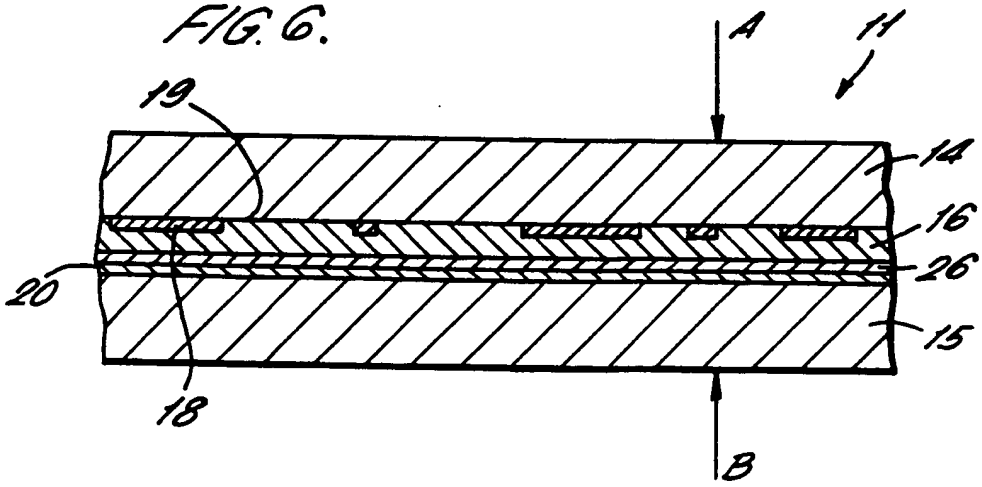


FIG. 6.



INTERNATIONAL SEARCH REPORT

Inte tonal Application No
PCT/GB 99/01987

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B32B27/06 B32B5/18 B42D15/00 B42D15/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B32B B42D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 618 630 A (BENOIT GORDON L ET AL) 8 April 1997 (1997-04-08) cited in the application column 5, line 48 - line 53; claims column 6, line 35 - line 61	1,17,18
A	WO 83 00659 A (COMMW SCIENT IND RES ORG ;AUSTRALIA RESERVE BANK (AU)) 3 March 1983 (1983-03-03) cited in the application page 8, line 1 -page 11, line 22; claims; figures	1,17,18
A	WO 97 01438 A (MOBIL OIL CORP) 16 January 1997 (1997-01-16) cited in the application page 2, line 7 - line 29; claims 1,7,12-20 page 4, line 2 - line 30	1,17,18

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 September 1999	30/09/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Pamies Olle, S

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Int. ional Application No
PCT/GB 99/01987

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication.where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 374 763 A (GAO GES AUTOMATION ORG) 27 June 1990 (1990-06-27) column 5, line 5 -column 6, line 34; claims; figures	1,6,9,12
A	FR 2 279 548 A (CIT ALCATEL) 20 February 1976 (1976-02-20) claims; example 3	1,13,14, 18
P,A	US 5 815 292 A (WALTERS GLENN J) 29 September 1998 (1998-09-29) column 1, line 7 - line 12; claims; figures	1,4

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte ional Application No
PCT/GB 99/01987

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 5618630	A	08-04-1997	US	5716695 A	10-02-1998
			AU	688537 B	12-03-1998
			AU	2949295 A	19-01-1996
			CA	2190845 A	04-01-1996
			CN	1176619 A	18-03-1998
			CZ	9603756 A	11-06-1997
			EP	0767738 A	16-04-1997
			JP	10504772 T	12-05-1998
			NZ	289597 A	19-12-1997
			PL	317838 A	28-04-1997
			SK	168496 A	04-06-1997
			WO	9600146 A	04-01-1996
			ZA	9505144 A	23-12-1996
WO 8300659	A	03-03-1983	AU	558476 B	29-01-1987
			CA	1272231 A	31-07-1990
			DE	3248989 C	23-01-1992
			DE	3248989 T	05-04-1984
			GB	2125337 A,B	07-03-1984
			IT	1152046 B	24-12-1986
			JP	3078278 B	13-12-1991
			JP	58501318 T	11-08-1983
			NL	8220285 T	01-12-1983
			SE	457426 B	27-12-1988
			SE	8305110 A	22-09-1983
			US	4536016 A	20-08-1985
WO 9701438	A	16-01-1997	CA	2220444 A	16-01-1997
			US	5698333 A	16-12-1997
			AU	700625 B	07-01-1999
			AU	2999295 A	30-01-1997
			CZ	9703606 A	15-04-1998
			EP	0857108 A	12-08-1998
			HU	76649 A	28-10-1997
			PL	323859 A	27-04-1998
			SG	55108 A	21-12-1998
			SK	155597 A	03-06-1997
			ZA	9505145 A	23-12-1996
EP 0374763	A	27-06-1990	DE	3843077 A	28-06-1990
			AT	106323 T	15-06-1994
			DE	58907775 D	07-07-1994
			ES	2054998 T	16-08-1994
			US	5324079 A	28-06-1994
FR 2279548	A	20-02-1976	BE	831505 A	19-01-1976
			DE	2532935 A	12-02-1976
			DK	339475 A	27-01-1976
			ES	439734 A	16-05-1977
			IT	1040079 B	20-12-1979
			JP	51044175 A	15-04-1976
			LU	73047 A	01-07-1976
			NL	7508998 A	28-01-1976
			SE	7508482 A	27-01-1976
US 5815292	A	29-09-1998	NONE		